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Incorporating metrology techniques to analyse and minimise the bias introduced in temperature series related to the automation of weather stations

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The reliability and robustness of any climate or climate change study strongly depends on the availability of climate time-series of proven quality and homogeneity. A number of artificial causes can compromise the statistical homogeneity of century-long air temperature records and shorter time-series. For example, the progressive introduction of automatic weather stations (AWS) during the last decades incorporates systematic biases in historical temperature series produced by conventional observation systems. However, both ways to measure air surface temperature: the conventional (CON) and the automated (AWS) ways rarely have a metrological traceability to assess the measurement uncertainty.

The current changeover to AWS measurements tends to introduce a bias in temperature series, which will be analysed in this contribution from two perspectives: the Statistical (absolute and relative homogenisation adjustments) and Metrological (an instrumental calibration strategy) approaches, carried out under the ENV/REG5 (Research Excellence Grant5) of the parent EMRPA169/EURAMET/FP7 MeteoMet -Metrology for Meteorology- project. A sensor traceable to primary standards has been installed at the Observatori de l'Ebre (Ebro's Observatory, Roquetes, Spain) that hosts a continuous climate record since 1905 and parallel measurements (AWS vs. CON) since 1989 to determinate the shape and size of this bias and to analyze the importance of the introduction of instrument calibration uncertainty to reduce the automation impact on the historical temperature series and also reduce the length of parallel measurements.

The complete traceability procedure (the calibration against primary standards and the evaluation of the calibration uncertainties) is here illustrated and the results of the comparisons among the uncalibrated-AWS vs. CON and the calibrated-AWS vs. CON comparisons will be shown. This contribution represents a pioneer exploratory example of the incorporation of metrological techniques in the scientific field of high-quality climate time-series development, whose relevance lies not only in the incorporation of measurement uncertainty, but also in climatic analysis.